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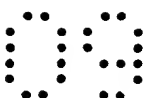
*Andrew Gervay*

Dated 17 DEC 1998

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1. Your reference

PB752/GB/RGMS

2. Patent application number

(The Patent Office will fill in this part)

9805746.6

3. Full name, address and postcode of the or of each applicant (underline all surnames)

ALBRIGHT & WILSON UK LIMITED  
210-222 HAGLEY ROAD WEST  
OLDBURY  
WEST MIDLANDS  
B68 0NN

Patents ADP number (if you know it)

If the applicant is a corporate body, give the country/state of its incorporation

ENGLAND

4. Title of the invention

BIOCIDAL COMPOSITIONS AND TREATMENTS

5. Name of your agent (if you have one)

"Address for service" in the United Kingdom to which all correspondence should be sent (including the postcode)

R G M SAVIDGE  
ALBRIGHT & WILSON UK LIMITED  
PATENTS DEPARTMENT  
PO BOX 3, 210-222 HAGLEY ROAD WEST  
OLDBURY  
WEST MIDLANDS  
B68 0NN

Patents ADP number (if you know it)

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and (if you know it) the or each application number

Country

Priority application number  
(if you know it)

Date of filing  
(day / month / year)

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application

Date of filing  
(day / month / year)

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? (Answer 'Yes' if:

- a) any applicant named in part 3 is not an inventor, or
  - b) there is an inventor who is not named as an applicant, or
  - c) any named applicant is a corporate body.
- See note (d))

**Patents Form 1/77**

9. Enter the number of sheets for any of the following items you are filing with this form.  
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Continuation sheets of this form NONE  
Description 3 PAGES  
Claim(s) NONE  
Abstract NONE  
Drawing(s) NONE

10. If you are also filing any of the following, state how many against each item.

Priority documents NONE  
Translations of priority documents NONE  
Statement of inventorship and right to grant of a patent (Patents Form 7/77) NONE  
Request for preliminary examination and search (Patents Form 9/77) NONE  
Request for substantive examination (Patents Form 10/77) NONE  
Any other documents (please specify) NONE

11. I/We request the grant of a patent on the basis of this application.  
Signature Date 18 March 1998  
R G M SAVIDGE - By Power of Attorney  
12. Name and daytime telephone number of person to contact in the United Kingdom  
MR R G M SAVIDGE  
0121 420 5430

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PB752/GB

## BIOCIDAL COMPOSITIONS AND TREATMENTS

The present invention relates to synergistic biocidal mixtures containing hydroxymethyl phosphonium biocides which exhibit enhanced biocidal penetration and/or reduced foaming.

GB 2 145 708 describes biocidal uses of tetrakis (hydroxymethyl) phosphonium salts, referred to herein collectively as "THP". GB 2 178 960 describes synergism between THP and surfactant. GB 2 228 680 describes synergism between THP and certain aldehydes.

THP formulations are increasingly widely used as biocides for water treatment in treating cooling water, process water e.g. in pulp and paper manufacture, drilling fluids and other aerobic water systems, as well as in anaerobic systems such as oil field formation water, injection water, produced water and water used in hydrostatic testing. Advantages include rapid and effective bactericidal activity and environmental acceptability. Particularly in systems where slime forming bacteria proliferate (e.g. in aerobic systems such as cooling water) it has been found desirable to use THP formulations containing synergistic amounts of a surfactant according to GB 2 178 960, in order to improve cost effective biocidal action. However such formulations cause foaming problems. Attempts to combine THP with other biocides (e.g. aldehydes), which do not cause foaming, have not been able to provide such effective biocidal action especially against slime forming bacteria, and/or have detracted from the favourable environmental profile of THP.

We have now discovered that combinations of THP with water soluble alkyl glycol ethers provide strongly synergistic biocidal formulations which give excellent penetration of bacterial slime and improved activity against planktonic bacteria without causing excessive foam.

Our invention provides a biocidally synergistic mixture comprising THP and at least one water soluble alkyl glycol ether.



According to a second embodiment the invention provides a method of treating aqueous systems contaminated, or liable to contamination, with bacteria, fungi or algae which comprises applying thereto separately or together a biocidally active amount of the components of a synergistic mixture as aforesaid.

The aqueous system may, for instance, be contaminated with bacterial slime. The invention is of use for treating aerobic systems and also for anaerobic systems.

The THP salt is preferably the sulphate, chloride or phosphate. However any water soluble salt may be used including the nitrate, phosphite, bromide, fluoride, carbonate, acetate, formate, citrate, borate, or silicate. In fact any counter ion which is chemically compatible with the THP cation may be used, the main criteria for selection being economic.

The glycol ether is preferably a water soluble compound of the formula  $\text{HO}[\text{CR}_2\text{CR}_2\text{O}]_n\text{R}'$  where each R is methyl, ethyl or preferably H, provided that the total number of carbon atoms per  $[\text{CR}_2\text{CR}_2\text{O}]$  unit does not exceed 4, more preferably is not more than 3 and most preferably is 2, R' is ethyl or preferably methyl and n is from 1 to 10, especially 1 to 5, typically 1 to 3, preferably 2.

The relative weight proportions of the THP and the glycol ether may range from 1:1000 to 1000:1, preferably 1:200 to 500:1, more preferably 1:100 to 200:1, most preferably 1:50 to 100:1, especially 1:10 to 50:1, more usually 1:5 to 20:1, e.g. 1:1 to 10:1.

The mixture is typically used at a dosage of 1 to 1500ppm by weight THP based on the weight of water to be treated, usually 2 to 500, especially 5 to 250, e.g. 10 to 150.

### **Example**

An aqueous solution comprising 50% THPS and 2% methyl carbitol (diethylene glycol monomethyl ether) was added to alginate beads infected with sulphate reducing bacteria. When dosed at 250ppm, the solution gave a 100 fold reduction in bacterial counts, compared with a control, after two weeks incubation. A mixture of 50% THP and 2% cationic surfactant was inactive at this concentration.

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At 500ppm the solution gave a total kill.

The example of the invention also showed superior performance to conventional THP surfactant formulations, to methyl carbitol and to THP alone in reducing both sulphate reducing and planktonic aerobic bacteria.

The example gave less than half the foaming observed using surfactant containing formulations.

The mixture also gives effective control over fungi and algae.

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